

*JW 9/17*

1 A drill string drive comprising:  
2       a motor adapted to rotate a drill string;  
3       a sensor adapted to detect the rotation of said  
4       drill string; and  
5       a computer receiving rotational information from  
6       said sensor, said computer transmitting control  
7       signals to said motor, said computer programmed  
8       to control said motor to advance said drill  
9       string to a predetermined angle.

1 2. A drill string drive comprising:  
2       a motor adapted to rotate a drill string;  
3       a sensor adapted to detect the rotation of said  
4       drill string; and  
5       a computer receiving rotational data from said  
6       sensor and transmitting control signals to said  
7       motor, said computer programmed to control the  
8       rotation of said motor, said computer advancing  
9       said drill string a predetermined angle in a  
10      first direction and then reversing said  
11      rotation and advancing said drill string a  
12      predetermined angle in a second direction.

*W.L.G.*

1 A drilling system comprising:  
2 a motor;  
3 a drill string connected to said motor;  
4 a first sensor adapted to detect the rotation of  
5 said motor;  
6 a bit at the distal end of said drill string;  
7 a second sensor adapted to detect the orientation of  
8 said bit;  
9 a computer adapted to receive information from said  
10 first sensor and said second sensor.

1 A drill string drive comprising:  
2 a hydraulic motor adapted to rotate a drill string,  
3 said hydraulic motor having a fluid supply  
4 system;  
5 an operating valve located in said fluid supply  
6 system, said operating valve causing fluid to  
7 rotate said hydraulic motor in a first  
8 direction when open, and  
9 a counterbalance valve located in said fluid supply  
10 system, said counterbalance valve causing said  
11 hydraulic motor to resist external rotational  
12 forces in said first direction when said  
13 operating valve is closed.

*Mar 3*)  
A drilling method comprising:  
monitoring the rotation of a drill string with a  
sensor;  
transmitting said rotational information to a  
computer;  
controlling a motor that rotates said drill string  
with said computer; and  
rotating said drill string to a predetermined angle.

*5*)  
A drilling method comprising:  
monitoring the rotation of a drill string with a  
sensor;  
transmitting said rotational information to a  
computer;  
controlling a motor that rotates said drill string  
with said computer; and  
oscillating said drill string between predetermined  
angles.

*Shay*

1 A directional drilling method comprising:  
2 monitoring the rotation of a drill string with a  
3 first sensor;  
4 monitoring the orientation of a downhole tool with a  
5 second sensor, said downhole tool being  
6 connected to the end of said drill string;  
7 transmitting said drill string rotational  
8 information to a computer;  
9 transmitting said downhole tool orientation  
10 information to said computer;  
11 controlling a motor that rotates said drill string  
12 with said computer; and  
13 rotating said drill string with said computer  
14 controlled motor to a predetermined angle such  
15 that said downhole tool is rotated to a  
16 predetermined orientation.